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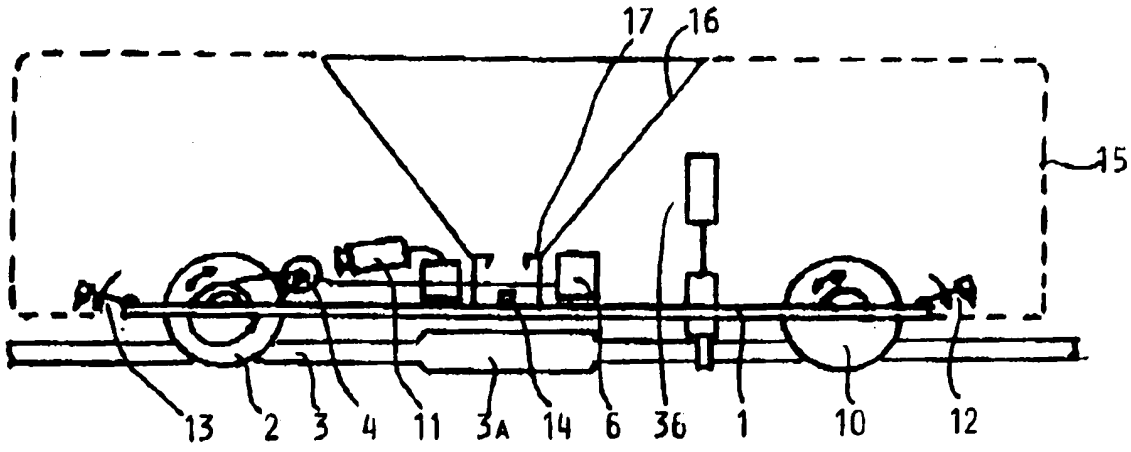

(57) Abstract

A device for the automatic control of electrical high voltage lines is described, comprising a first support (1), a driving wheel (2), for lying against the line (3) with a remotely controlled driving device (4), means for remotely controlled automatical measurement of physical data at the joint (3a) in question, and means for the transfer of measurement data to a receiver and a shielding means (15) for these means. The device is characterized primarily in that it is provided with guide rail means (7, 8, 9) for steering of the device, carried by a lifting means like a helicopter or crane, of same to lying of said driving wheel (2) against a line, and that said physical measurement concerns non contacting as well as contacting measurement in the vicinity of and at the joint in question.

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A DEVICE FOR THE AUTOMATIC CONTROL OF JOINTS IN ELECTRICAL HIGH VOLTAGE LINES

The present invention relates to a device for the automatic control of lines for high voltage electricity, comprising a first support, a driving wheel for lying on the line with a remotely controlled driving device, means for remotely controlled automatic measurement of physical data at the joint in question and means for the transfer of measurement data to a receiver and shielding means for these means.

Such a device is known from the US Patent No US 4,904,996.It seems, that its usefulness is somewhat limited, as it only measures physical data in the form of rays. Furthermore it lacks means for steering in onto the line in question. It does not seem to be probable, that the device in US 4,904,996 has been able to replace the manual work, that has hitherto been connected to maintenance work on electrical high voltage lines. As these must be provided with joints it is necessary to control these joints with certain time intervals, and to repair them if needed. Such work is normally done after the high voltage line has been taken from operation, that is to say been made dead.

The object of the present invention thus is to provide a device of the type mentioned by way of introduction, that can be utilized when the high voltage line is in operation and that is generally usable for all types of physical measurements and that can safely be steered in to lie upon the line, that is to be controlled.

According to the invention such a device is characterized primarily in that it is provided with guide rail means for steering in of the device , and that it is carried by lifting means like an helicopter or crane, of same for applying of said driving wheel to a line, and that said physical measurement means non contacting as well as contacting measurement in the vicinity of and at the joint in question.

In one advantageous embodiment of the invention, the support is provided, in addition to said driving wheel, with at least one second wheel, arranged in a distance perpendicularly to said driving wheel, the second wheel being adjustable as to the distance to the driving wheel. With this arrangement the device can be adapted to utilization in high voltage systems with parallel lines.

The guide rail means can be formed in different ways, but advantageously it comprises two substantially triangle formed guide elements, each of them attached to its horizontal side of said support, the guiding elements diverging downwards, outwardly.

The lifting means most effectively consists of a helicopter. Considering the need for being able to release the device from the helicopter in case of emergency it is suitable to provide a remotely controlled releaseable lifting element between the support and the lifting means.

This lifting element can be constructed in different ways. The device may comprise a guide means attached to said support, e g in the form of a hopper, diverging upwardly, the guide means being provided with a first locking element. A second locking element is attached to a line means intended to be carried by said lifting means. The first and second locking elements are constructed to form together automatically said lifting element in the form of a locking, carrying joint, remotely controlled releasable.

For safety reasons, insulators should be arranged between the lifting element and the support, also if the line means is per se non electrical conducting, e g from Kevlar.

The means for transferring of measurement data to a receiver, in the helicopter, if such one is utilized, suitably comprises a fibre optic link. Considering the need for being able to separate the lifting means, e g a helicopter from the support, the fibre optic link suitably comprises a first and a second part, which are kept in fibre optical connection by a connecting means, which is formed to bring the two parts apart under the influence of a predetermined tensile force.

A means for the measurement of electrical voltage over the joint suitably comprises two pointed elements, provided to automatically, by remote control, penetrate into the surface layer of the line and thus form the ends of an electrical measurement shunt circuit over the joint.

A means for the measurement of the amperage through the joint on the other hand, suitably comprises a measurement loop, that is formed from at least two clamp parts, in such a way, that it will automatically open and then close around the line when it is led against this, and automatically open when it is drawn from the line.

The invention will be described in the following, reference being made to the accompanying schematic figures.

Of these,
figure 1a shows a view of one embodiment of the device according to the invention, partly in section,

figure 1b shows a second locking element, intended to be carried, via a line means by a lifting means, like a helicopter,
figure 1c shows a first device for remotely controlling of the driving device and automatical measurement of physical data,
figure 1d shows a second device for remotely controlling the second locking element,
figure 2 shows a guide rail means for steering of the device to lying against the line,
figure 3 shows an alternative form of lifting the support with insulators and two line means,
figure 4 shows a view along two lines of the guide rail means with driving wheels, and an extra wheel,
figure 5 shows a driving wheel with an adjustable extra wheel,
figure 6 shows an alternative embodiment of the device according to the invention, carried by a helicopter,
figure 7 shows a detail of a releasable lifting element and a fibre optic link in two parts with releasable connecting means,
figure 8 shows a view of a means for measurement of the amperage through a joint.

In figure 1a a first support is denoted by 1, a driving wheel by 2, for applying to a line 3, driven by a driving device 4. A first remotely controlled device for controlling of said driving device 4 comprises a transmitter 5 and a receiver 6. From figure 2 the form of guide rail means 7,8 for steering of the device to lying of its driving wheel 2 and other wheel 10 on the line 3 and its joint 11 can be seen . A camera means 12 with a device for remotely transferring of a picture of the joint 11 and its environments is shown in figure 1a. Furthermore there are means for remotely controlled automatic measurement of physical data at said joint 11, namely two pointed elements 12, 13, which are arranged to automatically, by remote control, be brought to penetrate into the surface layer of the line 3 and thus form the ends of an electrical measurement shunt loop over the joint 11. Furthermore there are means 36 for the measurement of the amperage though the joint 11. This means can, as is shown in figure 8, be formed like a spring tensioned claw, that opens when it is led over the line, and then closes around the line, so that a circuit is formed in a way known per se, for the measurement of the amperage through the line and thus through the joint 11.According to figure 8 the means comprises two guide plates 37, 38, each of them attached to a ring halve 39 and 40 made by iron, which are kept together by a spring 41. On one of the ring halves, there is provided a coil as part of a circuit 42, in which a current,is induced, the strength of which can be read on the amperemeter 43.

The device is furthermore provided with not shown, necessary measurement circuits and means for the wireless transfer of measurement data to a receiver. An important part of

the device is a shielding device 15 for shielding of said means for the automatical measurement of physical data to uniform potential.

The device comprises, furthermore, a guide means 16 in the form of a hopper, open upwardly, provided with a first locking element 17, intended to cooperate with a second locking means 18, attached to a line means intended to be carried by a lifting means like a helicopter or a crane. The locking elements 17,18 are constructed to form automatically, a locking, carrying joint, which is releasable by the remote control of a second remote control device 20. In figures 4 and 5 an embodiment of the device is shown, with an extra wheel 21 on the same shaft as the driving wheel 2, intended to lie on a line parallel to the first line 3. In an alternative embodiment the extra wheel 21 is spring tensioned 22 in order to be adaptable to somewhat varying distances between the lines.

In the figures 3, 6 and 7 there is shown an alternative embodiment of the device according to the invention. In this four insulators 23 are provided, attached to the support 1.They are also, as is shown in figure 3 connected to two line means 24, which are carried by the lifting means in question, in figures 6 and 7 shown with a helicopter as an example, carrying a line 26. The transfer of measurement values from the means for the measurement of physical data is performed via a fibren optic link 27, 28 to an optoconverter 29 and further to a computer 30 in the helicopter. The carrying line 26 is kept connected to the helicopter 25 by a lifting releasable element 31, controlled from the helicopter. Furthermore the first and second parts 27 and 28 of the fibre optic link are kept in fibre optic connection by a connecting means 32, which is provided to bring the two parts to separate under the influence of a predetermined tensile force. This will thus happen if, in a situation of emergency, the lifting means must be separated from the device. The connecting means comprises two permanent magnets 33 and 34, which are kept under a certain pretension by a tensile spring 35.

Patent claims

1. A device for the automatic control of joints in lines for electrical high voltage lines, comprising
a) a first support (1),
b) at least one driving wheel (2) for lying on a line (3),
c) a driving device (4) for driving of said wheel,
d) a first remotely controlled device (5,6) for the control of said driving device,
e) means for remotely controlled, automatic measurement of physical data at said joint, (3a) comprising necessary measurement circuits, and means for the transfer of measurement data to a receiver,
f) shielding means (15) for shielding of means (12,13,14) according to e) above to a uniform potential
characterized in that
the device is provided with guide rail means (7,8,9) for steering of the device, carried by a lifting means like a helicopter or crane, of same to lying of said driving wheel (2) against a line, and that said physical measurement concerns non contacting as well as contacting measurement in the vicinity and at the joint in question.

2. A device according to claim 1,
characterized in that
the support (1) in addition to said driving wheel (2) is provided with at least one second wheel (21) provided in a distance perpendicularly to said driving wheel (2), the second wheel being adjustable as to the distance perpendicularly to the driving wheel (2).

3. A device according to claim 1 or 2,
characterized in that
said said guide rail means (7,8,9) for steering of the device to lying of said driving wheel (2) against a line (3) comprises two substantially triangle formed guide elements (7,8), each of them attached to its horizontal side of said support (1), the guide elements diverging downwards, outwardly.

4. A device according to any of claims 1 to 3,
characterized in that
there is provided a remotely controlled releasable lifting element between the support (1) and said lifting means.

5. A device according to claim 4,
characterized in that
it comprises a guide means (16) attached to said support (1), preferably in the form of a hopper, diverging upwardly, the guide means being provided wit a first locking element (17), and that it comprises a second locking element (18), which is attached to a line means (19) intended to be carried by said lifting means, the first and second locking elements (17,18) being provided to automatically form together said lifting element in the form of a locking, carrying joint, remotely controlled, releasable.

6. A device according to claim 4 or 5,
characterized in that
insulators are provided between the lifting element and the support (1).

7. A device according to any of claims 1 to 6,
characterized in that
the means for transferring measurement data to a receiver comprises a fibre optic link.

8. A device according to claim 7,
characterized in that
the fibre optic link comprises a first and a second part, which are kept in fibre optic connection by a connection means, which is provided to bring the two parts apart under the influence of a predertermined tensile force.

9. A device according to any of claims 1 to 8,
characterized in that
a means for the measurement of electric voltage over the the joint (3a) comprises two pointed elements (12,13) which are provided to automatically, by remote control, be brought to penetrate into the surface layer of the line (3) and thus form the ends of an electrical measurement shunt circuit over the joint.

10. A device according to any of claims 1 to 9,
characterized in that a means for the measurement of the amperage through the joint (3a) comprises a measurement loop, which is formed from at least two clamp parts, so that it opens automatically and then closes around a line when it is led towards this, and automatically opens when its is drawn from the line

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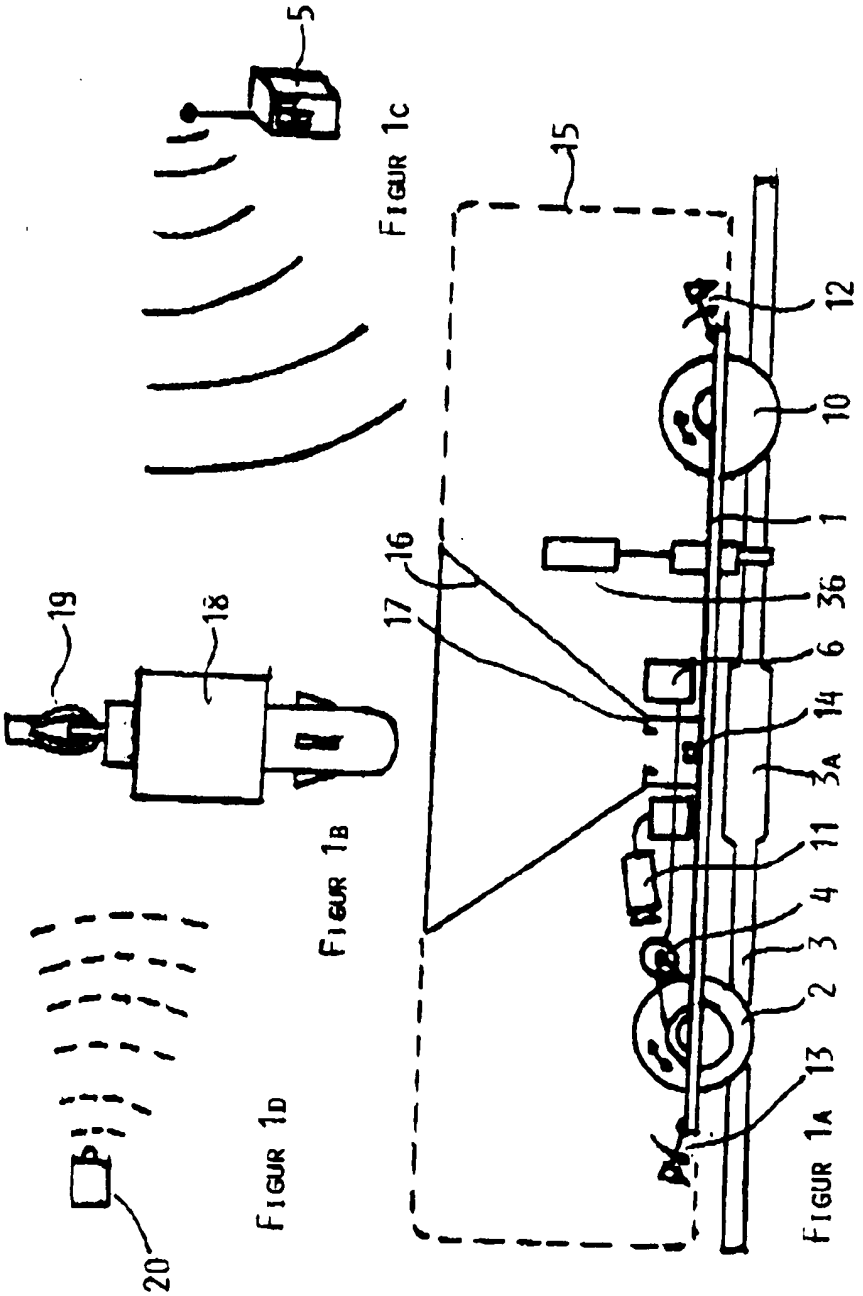
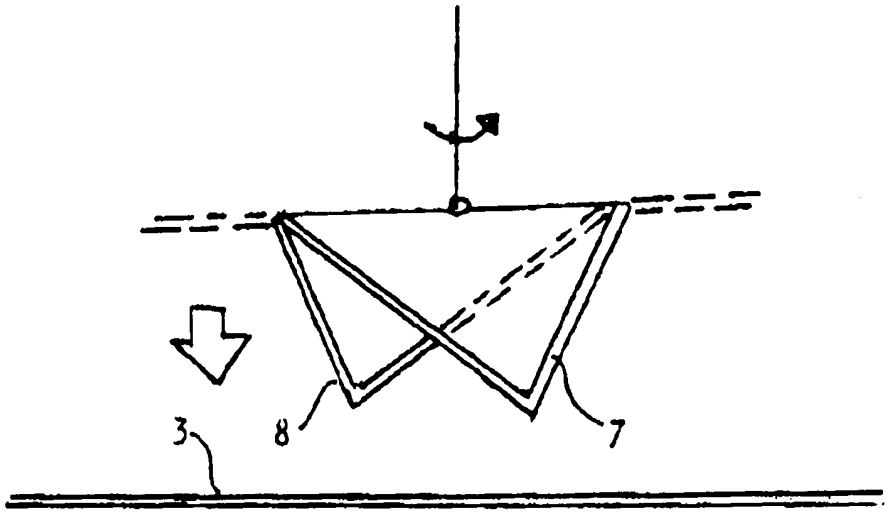


FIGUR 1C

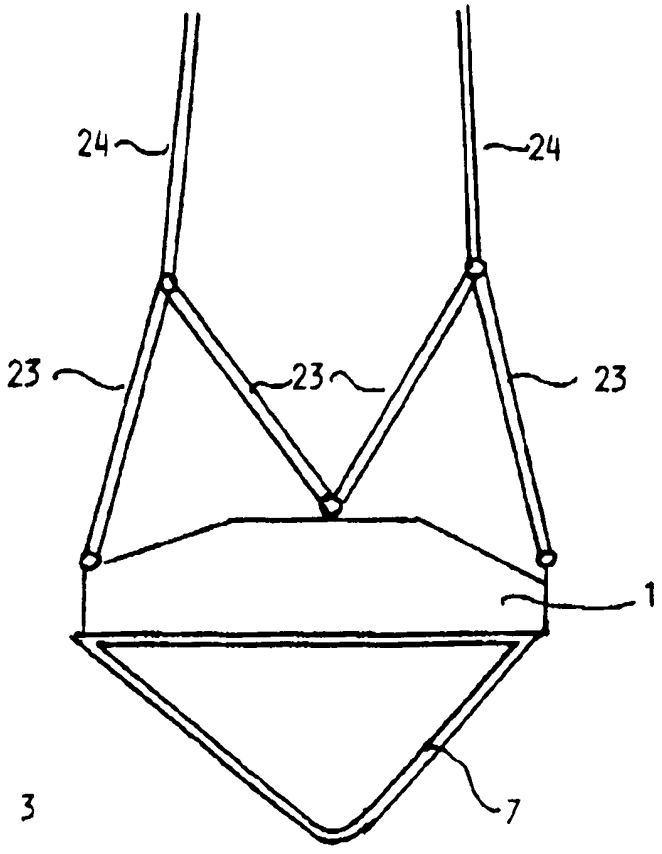
FIGUR 1B

FIGUR 1D

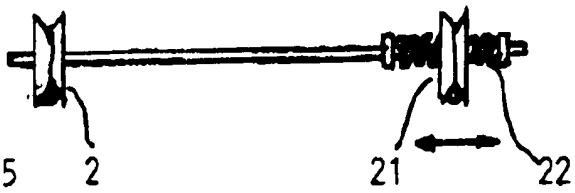
FIGUR 1A



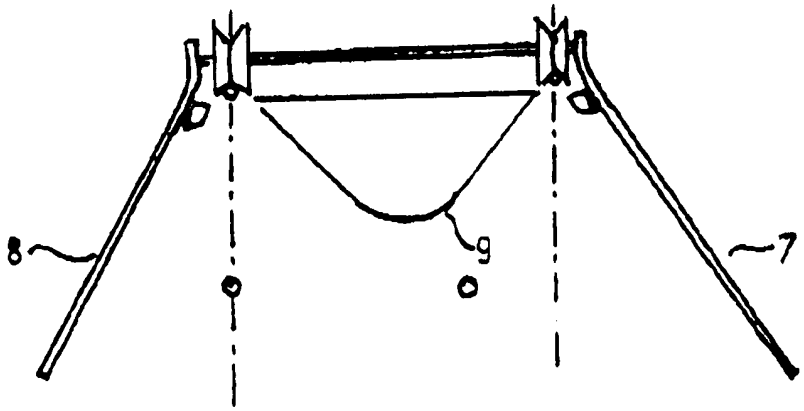
FIGUR 2



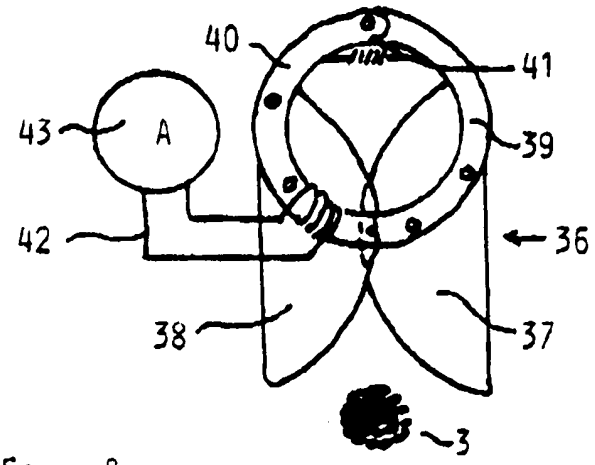
FIGUR 3



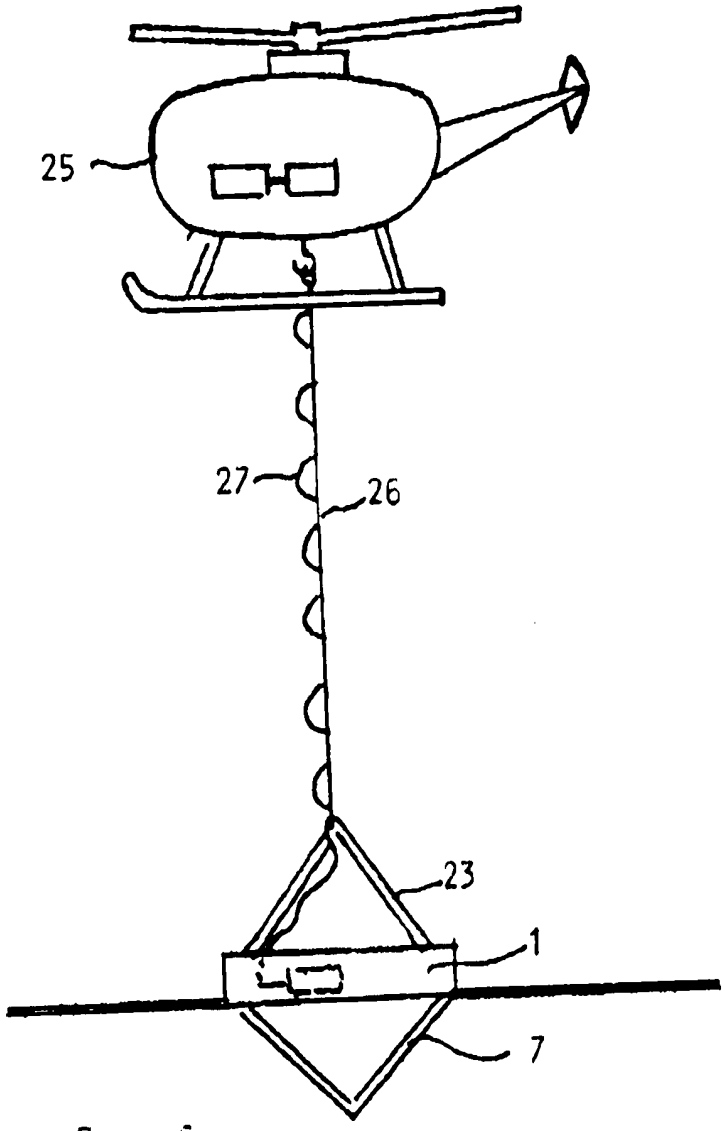
FIGUR 5



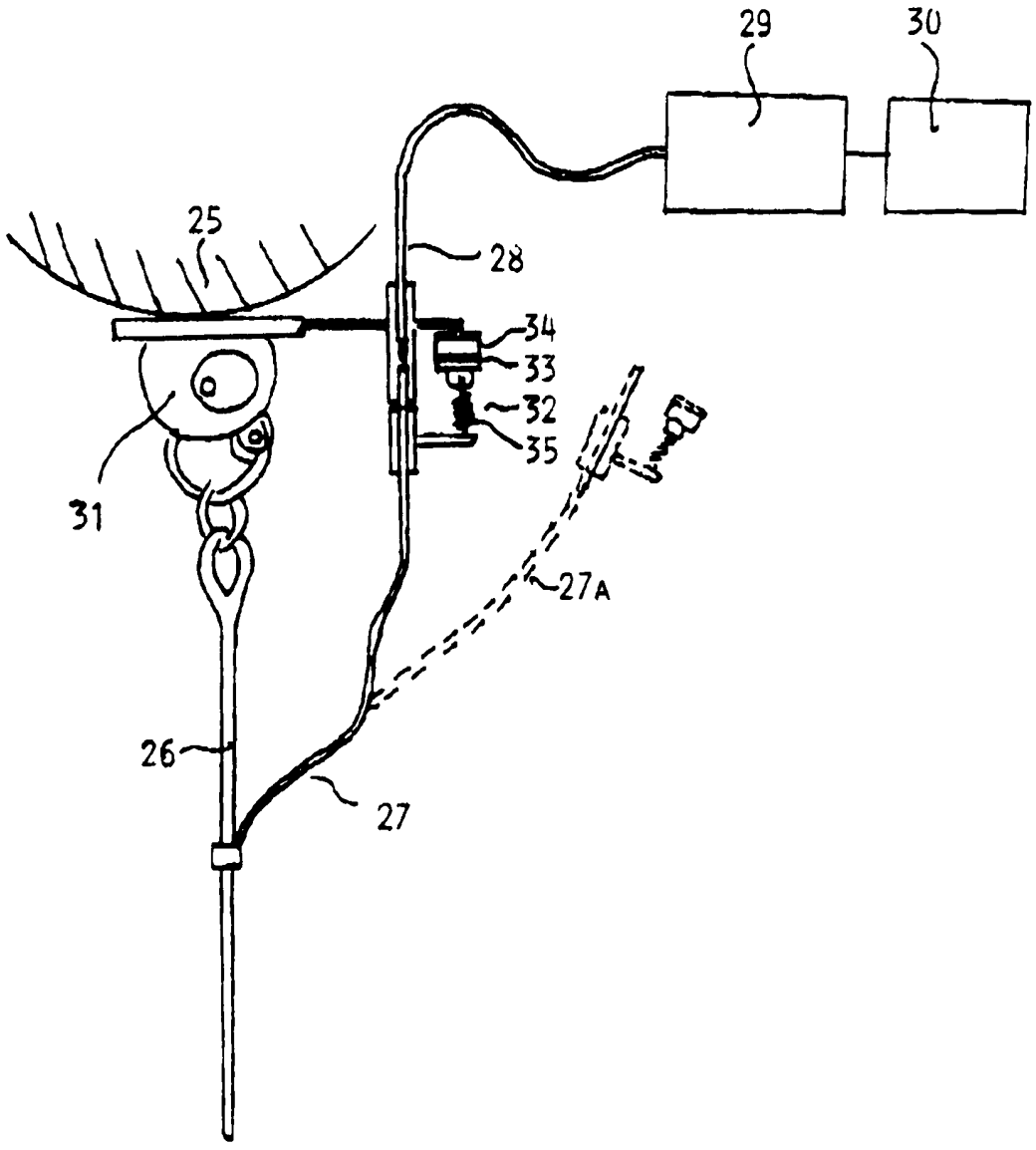
FIGUR 4



FIGUR 8



FIGUR 6



FIGUR 7